A "Strong Wind Experiment" in Support of the CBLAST "Hurricane Study"

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LONG TERM GOALS

The long-term objective is to improve the understanding the physics of the boundary layers of the Ocean-Atmosphere coupled system under strong wind conditions, by making careful measurements of winds, waves, ocean currents and mixed layer thermal structure with a three dimensional array of surface drifters. This will lead to a better knowledge of the heat and the momentum budgets, mesoscale divergence and vorticity field, shear in the upper 100 m and biological response to the intense mixing regimes that are expected in the upper ocean.

OBJECTIVES

1) Explore the thermal structure of the upper 100 m of the ocean, since it is an expression of the ocean adjustment under winds of increasing strength and, in turns, determines the evolution of a tropical depression into a hurricane. To this end we want to obtain accurate measurements of the velocity field of the ocean at two different depths, so that vorticity, divergence and shear can be computed. The ocean forcing will be described from measurements of air pressure, wind speed, wind direction and biological activity (algal blooms) in the trail of a hurricane. All these data will be used to estimate the heat and the momentum budgets under a developing hurricane and to test the extent to which the linear theory is accurate in describing the effect of a synoptic wind on the ocean, or, in other words, if non-linear contribution of mesoscale structures have a significant effect. 2) Compare all the available wind measurements from NAVY operational drifters with QuickSCAT wind measurements. 3) Implement wave measuring capabilities on Minimet.

APPROACH

Modifications of the design of the platforms (Minimet and ADOS) are required in order to: 1) host new instruments; 2) make the packages robust enough to resist adverse conditions in a hurricane environment. These two points are being addressed by Prof. Peter Niiler, Mr. Andy Sybrandy and Mr. William Scuba (who has replaced Mr. Chris Martin). In addition, the modified instruments need to be certified for operational Air Force Hurricane Hunter deployment. We have planned the deployment of Minimet pairs from C-130 aircrafts in front of a hurricane. The Minimet drifters are equipped with GPS positioning to achieve an accuracy in the location of ~ 10 m. Objective 2) is performed by Dr Jan Morzel.

WORK COMPLETED

The comparison of QuickSCAT with NAVY operational drifters, described at point 2) was completed. The Minimet drifter was certified for operational deployment by the US Air Force after trials with the 53rd Hurricane Hunter Squadron that took place at Keasler Air Force Base on July 2003. 16 Minimet drifters were deployed on 4 September 2003 in front of the hurricane Fabian (see figure 1). Work for the modification of the Minimet and ADOS design to host, respectively, a thermistor chain and wave sensors, is in progress.

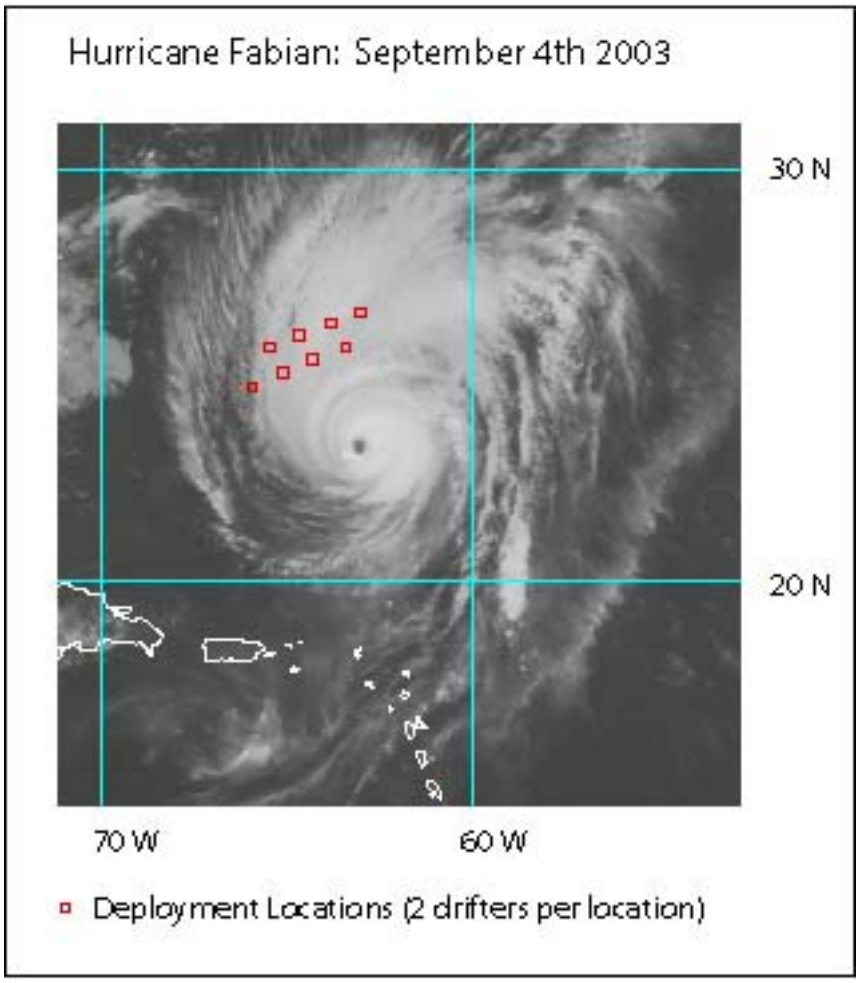

Figure 1

RESULTS

The deployment that took place on occasion of the Fabian Hurricane was a success, with 8 instruments still reporting after the hurricane. A second hurricane, Isabel, passed close to the drifters later in September. The data are now being analyzed. Figure 2 is an example of the quality of the atmospheric pressure measurements as a function of the distance from the centre of Hurricane Fabian. The main results of the comparison described at point 2 (objectives) showed a significant bias in the wind direction. The conclusions were communicated to the NAVOCEANO drifter manufacturer and at the October 2002 DBCP meeting.

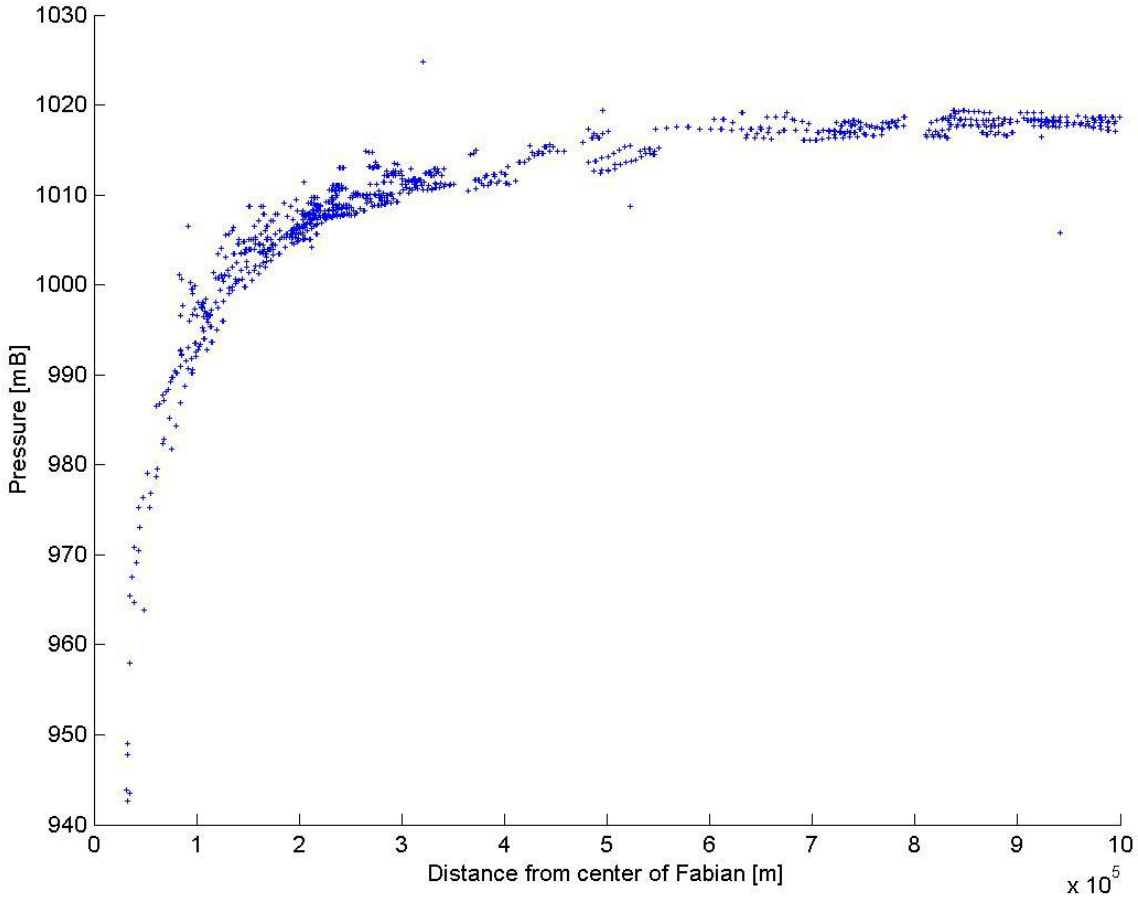

Figure 2

IMPACT/APPLICATIONS

Fabian and Isabel data of atmospheric pressure and STT were placed on GTS

TRANSITIONS

The MINIMET drifter is available on a commercial basis.

RELATED PROJECTS

Within the NOAA/OGP funded the "Global Drifter Programme", support has been obtained for the construction and for the deployment of Minimets for the 2004 Season